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# Perspectives on Online Learning and Technostress Experienced by Science and Non-science First-year University Students during COVID-19

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| **Article information** | |
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| **Abstract** | This study examined perspectives on online learning, focusing on synchronous and asynchronous modes and technostress experienced by first-year students during the COVID-19 pandemic. Based on a survey of 803 first-year university respondents, the results indicated that both science and non-science students held different perspectives on synchronous and asynchronous modes of learning. The students from both groups also experienced varying levels of technostress, with techno-overload being the most pronounced. There was a significant difference in attitudes towards online learning modes and in technostress between science and non-science students. Non-science students were more positive toward asynchronous modes and reported higher levels of techno-uncertainty. Thus, workload management and the integration of appropriate online learning methods to minimize technostress are recommended. |
| **Keywords** | Online Learning, Technostress, COVID-19 |
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## 1. Introduction

Due to government measures such as lockdowns and venue closures, students were forced to attend classes online throughout the academic year 2020–2021. This transition deprived them of the in-person interaction and socialization opportunities with peers in classroom environments they previously enjoyed on campus. Although students these days are commonly regarded as digital natives (Bhalla et al., 2021; Gentina, 2020; Mohr & Mohr, 2017), the transition to online learning could still induce stress for these students due to the abruptly increased use of learning technology (Li & Wang, 2021) and altered learning experience (Daniel, 2020).

Regardless of their familiarity with technology in daily life, university students in Thailand in general are assumed to have had limited experience with online learning prior to the COVID-19 pandemic and prior to their shift from secondary to university level. Therefore, with this transition from secondary to university study and shift in modes of learning, it is beneficial to examine how they perceived the two modes of online learning: synchronous and asynchronous modes. It is anticipated that the information gained could provide insights into learning amid the increasingly ubiquitous presence of online learning technology. While previous research studies (for example, Davis et al., 2019; Mällinen, 2001; Pei & Wu, 2019) primarily focused on either the benefits or effectiveness of online learning, or on technostress in workplace settings, less is known about technostress experienced by first-year university students during the COVID-19 pandemic in Thailand.

Thus, the present study places a special emphasis on exploring the perspectives on the two modes of online learning and the technostress experienced by digital native students from both science and non-science first-year university students during the COVID-19 pandemic. Specifically, the study focuses on four types of technostress: techno-overload, techno-complexity, techno-uncertainty, and techno-insecurity.

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**Research Objectives (ROs)**

The present study aims to:

1. examine perspectives on online learning—synchronous and asynchronous—expressed by science and non-science first-year university students, and
2. investigate the technostress experienced by science and non-science first-year university students.

## 2. Literature Review

### 2.1 Online learning

Online learning, also known as e-learning, is an instructional and learning method that utilizes electronic media to facilitate connections between students and instructors (Singh & Thurman, 2019). It involves the delivery of content through multimedia and interactive technologies, allowing for flexible and remote access to educational materials. The content for online learning is often delivered through Learning Management Systems (LMSs), which encompass various components such as learning content and media, information delivery, communication systems, instructional interaction, assessment and evaluation systems, learning support systems, and the involvement of students and instructors (Od & Ei, 2014; Teo et al., 2014). Two primary modes of online learning are synchronous and asynchronous learning. The synchronous mode involves real-time online interaction between students and teachers through video conferences, teleconferences, discussions, and live lectures, while the asynchronous mode relies on LMSs for self-paced learning and does not require immediate interaction (Iramaneerat, n.d.; Sulha et al., 2021).

### 2.2 Technostress

The concept of technostress is understood as a contemporary negative state of adaptation arising from an individual's incapacity to effectively cope with new computer technologies in a psychologically healthy manner (Brod, 1982). In addition, technostress can be defined as "the negative psychological link between people and the introduction of new technologies" (Agboola & Olasanmi, 2016, p.

253). Technostress can be classified into four types, namely techno-overload, techno-complexity, techno-uncertainty, and techno-insecurity (Marchiori et al., 2019; Ragu-Nathan et al., 2008).

Li and Wang (2021) further elaborated on these four types of technostress as follows. First, techno-overload occurs when technology users are expected to deliver increased speed and productivity within tighter deadlines as their work heavily relies on technology. This can lead to adverse physical and psychological effects, such as fatigue and muscle pain. Second, techno-complexity refers to situations where the complexity of information and communication technology (ICT) makes individuals' tasks more challenging, requiring continuous skill acquisition and relearning to cope with evolving or complex technology. Third, techno-uncertainty arises from doubts regarding the reliability of technology like network systems and electronic equipment, including concerns about their capabilities and connection quality. This uncertainty can instill fear about the effectiveness of using technology for instructional management. Lastly, techno-insecurity is closely related to techno-complexity. As technology becomes more complex, users may feel more uncertain about keeping up with its functions and usage, leading to increased stress.

### 2.3 Perspectives on Online Learning

There have been studies reporting the effectiveness of online learning (e.g., Hussein et al., 2020; Maqableh & Alia, 2021; Satyawan, 2021). The synchronous mode, which allows for real-time interaction, collaboration among peers, and immediate feedback from teachers, has been found to be more effective than asynchronous learning (Libasin et al., 2021). Moreover, ithas been documented that the synchronous mode can help students practice their language skills, improve teaching and learning effectiveness, and promote engagement and communication between teachers and students in the EFL classroom (Mu'awanah et al., 2021). In addition to English language learning, the effectiveness of online learning has been evaluated in a diverse range of contexts, with one notable

example being a midwifery practicum, where students achieved high scores in knowledge and skill assessments as a result of the chance to view real-time sessions and review recorded sessions online (Yamsri, 2019).

On the other hand, Raymond et al. (2016) have argued that asynchronous learning approaches are more effective in enhancing academic achievements and intrinsic motivation for further learning compared to synchronous approaches. The limitations of synchronous learning, such as technical and connection issues, as well as time zone differences between students and instructors, have been emphasized in previous studies (Iramaneerat, n.d.; Lytvyn et al., 2021; Mu'awanah et al., 2021).

When it comes to students' preferences, students in some studies have shown a preference for face-to-face learning. For example, a study of students' preferences in a discussion-based course found that students believed that face-to-face learning allowed for more spontaneous participation and interaction, even though the test performance of students in both face-to-face and online learning groups were comparable (Kemp & Grave, 2014). Conversely, a survey conducted by Ngampornchai and Adams (2016) revealed that university students in Northeastern Thailand had a positive acceptance of and readiness for online learning as these students demonstrated competence in using online learning technology, despite their initial unfamiliarity with it.

A study carried out during the COVID-19 pandemic found that undergraduate students at a UAE university held both positive and negative views of online learning. Qualitative analysis of 45 students' essays revealed that students felt that online learning increased participation and was deemed convenient and safe, but distraction, workload, and technical problems were the drawbacks of online learning (Hussein et al., 2020). In the same vein, 483 students from two Jordanian universities held mixed views regarding online learning. Effectiveness, safety, convenience, and increased participation were the reasons

for students' positive views of online learning at the beginning of COVID-19. However, the students' negative views of online learning were due to distraction and reduced focus, workload, technology and unstable Internet connectivity, and inadequate support, making them dissatisfied with their learning experience, materials, interactions, assessments, and platform features (Maqableh & Alia, 2021).

### 2.4 Technostress in Education Settings during COVID-19

Instructors' roles are significant contributing factors to the experience of technostress in the context of online education since there are three critical success factors for online delivery: the technology itself, the instructors' previous experience with the technology, and the students' previous experience with the technology (Volery & Lord, 2000). The ability to adapt skillfully to digital learning environments (DLE) is positively influenced by both self-confidence and digital competence, although this relationship exhibits a comparatively weaker association among digital natives (Vergara-Rodríguez et al., 2022).

In response to the prevailing circumstances during the COVID-19 pandemic, instructors took various efforts to ensure the continuity of teaching, acknowledging the need for adjustments in expectations. Despite facing numerous obstacles, instructors reported a decrease in their initial reservations about online instruction. However, they encountered notable challenges in creating social, emotional, and cognitive engagement, meeting the diverse needs of students and providing comprehensive learning experiences that encompassed multiple dimensions (Müller et al., 2021). Instructors themselves experienced technostress when using social media and other ICT-based tools for collaborative learning (Christian et al., 2020; Estrada-Muñoz et al., 2021). Christian et al. (2020) conducted a study on technostress factors affecting the teaching performance of instructors in private universities in Jakarta during the COVID-19 pandemic. They identified techno-complexity as the variable with the greatest influence on teaching and instructional management efficiency, followed by techno-overload, techno-uncertainty, and

techno-insecurity. The authors emphasized that the spread of COVID-19 necessitated a transformation not only in instructional management but also in students' and instructors' adjustment to the sudden shift from traditional to online learning. Both students and instructors experienced stress related not only to the use of instructional technology but also to the extent of collaboration, communication, information sharing, and assessment associated with it

Other researchers have observed significant correlations between remote delivery of classes, social isolation, and stress. Li and Wang (2021) conducted a survey to examine the impacts of technostress inhibitors and creators in Chinese universities, providing valuable insights into the relationship between different types of technostress and their effects. In another study, which focused on first-year university students, it was found that within just four months following the onset of the COVID-19 pandemic, there was a sharp increase in moderate to severe anxiety (from 18.1% to 25.3%) and moderate to severe depression (from 21.5% to 31.7%) among the students at the same time as the shift to online learning (Fruehwirth et al., 2021).

Various factors are likely to have contributed to the technostress experienced during the abrupt transition and adjustment to online learning (Daniel, 2020). For instance, students who were not accustomed to studying lecture courses online may have experienced technostress, particularly if they faced challenges with weak Internet connections leading to signal disturbances and difficulties in submitting assignments (Moawad, 2020). Additionally, issues such as noise, heat, and poor online communication, including problems with data transfer speed and Internet network stability, may have further added to the technostress experienced by students (Prasertsong et al., 2021).

Moreover, the abrupt transition from the traditional classroom to online mode often resulted in an increased workload for students, leading to dissatisfaction with online learning and assessment conducted through platforms

like Zoom and Blackboard. This heightened workload, coupled with studying in non-conducive environments and experiencing social isolation, contributed to feelings of depression, anxiety, and stress among students (Fawaz & Samaha, 2020; Yang et al., 2021).

The immediate transition to online learning, along with the sudden increase in assignments and technical requirements, contributed to a sense of uncertainty and academic stress among many students (Moawad, 2020). In addition, the connection between techno-complexity and the lack of prior experience with instructional technology may have led to stress, despite students having skills in using electronic devices (Byungura et al., 2018).

Furthermore, Alibak et al. (2019) discovered that techno-uncertainty, characterized by feelings of anxiety and helplessness related to network issues, had detrimental effects on the well-being of students. They found that sluggish data transfer and Internet network instability were positively correlated with technostress in online learning, particularly in terms of techno-uncertainty.

According to Upadhyaya and Vrinda (2021), technostress among university students could be influenced by various factors. Their study revealed that Thai university students experienced a moderate level of techno-overload and techno-uncertainty, while techno-complexity and techno-insecurity were reported at a mild level. Interestingly, regardless of the specific type of technostress, there was a negative correlation between technostress and students' academic productivity. This suggests that higher levels of technostress are associated with lower academic performance among university students.

### 2.5 Science and Non-science Students

The university in this study offers several programs of study, which can be divided into two disciplines:

1. Science students. Their majors are science and technology-related.

2. Non-science students. Their majors are social science and humanities-related.

This research categorized students into disciplines for the following reasons. Firstly, the mandatory courses undertaken by students exhibited distinct natures, thereby necessitating their enrollment in general education courses, among which Foundation English was included. Secondly, a comprehensive analysis of previous literature has revealed notable disparities and noteworthy commonalities between science and non-science students.

Previous studies have examined the cognitive differences between science and non-science students in various aspects of scientific inquiry. Tsai (1996) found that science majors demonstrated a preference for experiment design and exploration of unanswered questions, while non-science majors tended to focus on confirming anticipated answers and mental preparation of procedures. This highlights the divergence in cognitive strategies employed by these two academic cohorts when faced with scientific challenges. Moreover, Liu and Tsai's (2008) investigation revealed that science majors exhibited less sophisticated perspectives on theory-laden and cultural-dependent dimensions of scientific knowledge compared to their non-science counterparts, indicating a difference in the depth and complexity of their belief and thinking systems.

Furthermore, discernible dissimilarities in argumentation quality between science and non-science students were observed by Hayat et al. (2019). Science students were more likely to provide empirical evidence to substantiate their claims, while non-science students relied more on forceful and debatable statements. These findings underscored the contrasting approaches to constructing arguments taken by these distinct cohorts, with science students prioritizing evidential support and non-science students placing greater emphasis on the persuasiveness and disputability of their arguments.

However, Chen and Samsudin (2022) proposed that despite these differences, there may be some similarities in the learning preferences between science and non-science students. They found that while preferred modes of learning tended to overlap, both preferred lecturer-centered learning, peer-collaborative learning, and autonomous learning utilizing technology. Another similarity is that both science and non-science first-year university students in Thai public universities possessed high overall and social adaptability but moderate academic and emotional adaptability (Petchprayoon et al., 2011).

Regardless of their study disciplines, Somasri (2013) found that first-year university students took immense joy in classroom and extracurricular activities, and those who had little interaction with their peers would experience a higher stress level and be less likely to successfully adapt to the university environment. Similarly, the construction of a social environment that allows a connection to like-minded, same-age peers during the first semester of the academic year has been found to be crucial for peer connections and experiencing the advantages of peer support and peer education in an informal setting during students' first year of university (Byl et al., 2016).

The research above has revealed some differences and similarities between science and non-science students. However, their perspectives on online learning as well as their levels of technostress have not yet been touched upon.

## 3. Methodology

This quantitative study utilized a survey approach to examine the perspectives of first-year university students on synchronous and asynchronous learning and the levels of technostress experienced by first-year university students.

### 3.1 Population and sample

According to the data from the university's Office of Registrar (2021), there were 6,778 first-year students at the university in the academic year 2020. Of these, 3,669 were from the science discipline, while 3,109 were from the non-science discipline. A total of 803 first-year students from all study programs answered the online questionnaire. The sample size of 803 students yielded less than +/- 3% sampling error (Yamane, 1973).

### 3.2 Instrument

A questionnaire created in Google Forms was used as a research instrument. The questionnaire comprised 45 questions. There were 44 closed-ended questions together with one open-ended question. The questionnaire was divided into three parts. Part 1 consisted of four closed-ended questions and one open-ended question inquiring about the personal information of the students. Part 2 consisted of 20 items using a 5-point Likert scale to identify their perspectives on online learning, which included synchronous and asynchronous modes. Part 3 also consisted of 20 items using the 5-point Likert scale dealing with four types of technostress: techno-overload, techno-complexity, techno-insecurity, and techno-uncertainty. These questions were in Thai to ensure that all Thai respondents understood all questions.

### 3.3 Validity and reliability of the questionnaire

To ensure validity, the questionnaire was approved by three experts who had extensive experience in English language teaching to ensure its content validity and language appropriateness.

A pilot study was conducted to determine the reliability of the questionnaire. A sample of 30 first-year students was selected to undergo the pilot to ensure the reliability of the questionnaire using Cronbach's alpha coefficient. The results of the analysis showed that the questionnaire had a reliability coefficient of 0.89. Part 2 questions asking students' perspectives on online learning for synchronous and

asynchronous had a reliability coefficient of 0.93, while Part 3 questions dealing with technostress had a reliability coefficient of 0.85. This set of questions thus proved reliable.

### 3.4 Data collection

Upon the approval of the university's Institutional Review Board (IRB) and the department of academic affairs of the university's language institution, the researchers requested the instructors of the language institute to forward the Google Forms link of the questionnaire (Appendix 1) to students in their classes to answer the questions. Data collection was completed in the first semester of 2021. The sample group included 484 female students (60.27%) and 319 male students (39.73%). More than half were 19 years old (54.92% or 441 students). The number of students belonging to the science discipline was 467 (58.16%), while the number of non-science students was 336 (41.84%).

### 3.5 Data analysis

By utilizing the Statistical Package for the Social Sciences (SPSS) version 19, the data were analyzed using descriptive statistics, which summarized the data by calculating means and standard deviations. Inferential statistics was also used to run Independent Sample *t*-tests (hereafter *t*-test) to determine mean differences between perspectives of science and non-science students toward the two modes of online learning (i.e., synchronous and asynchronous) and mean differences between technostress levels of science and non-science students. For all the *t*-tests performed, the significance level was set at $p<.05$.

## 4. Results and Discussion

**RO1: To examine perspectives on online learning—synchronous and asynchronous—expressed by science and non-science first-year university students**

Table 1 below describes science and non-science first-year students' perspectives expressed on the two modes of online learning.

**Table 1**

*Results of t-Test Perspectives on Online Learning by First-year Science and Non-science Students*

| Modes of Online Learning | Science students | | Non-science Students | | | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *t* | *Sig* |
| Synchronous | 3.08 | 0.80 | 3.18 | 0.81 | -1.71 | .88 |
| Asynchronous | 2.94 | 0.74 | 3.06 | 0.84 | -2.13 | .03 |

Table 1 demonstrates the different perspectives on synchronous and asynchronous modes of learning held by science and non-science students. The non-science students were slightly more positive towards both modes (synchronous: $M = 3.18$, $SD = 0.81$; asynchronous: $M = 3.06$, $SD = 0.84$) than their science counterparts (synchronous: $M = 3.08$, $SD = 0.80$; asynchronous: $M = 2.94$, $SD = 0.74$). However, when *t*-tests were performed, a statistically significant difference in attitudes was only found for the asynchronous mode, showing that non-science students were more positive than their counterparts ($t(801) = -2.13$, $p = .03$).

Although the university mandated a transition from face-to-face instruction on campus to synchronous and asynchronous online learning modes as one of the measures to contain the spread of COVID-19, non-science students were more positive about asynchronous modes than science students. A possible explanation for this is Tsai's (1996) finding that non-science students preferred mental preparation of procedures. In other words, the asynchronous mode provided the students with ample opportunity to prepare for upcoming lessons revisit previous ones, if needed. On the other hand, science students may be more interested in exploring unanswered questions and experiments (Tsai, 1996); hence, their learning preferences may be more aligned with the nature of the synchronous mode. At this point, it can be seen that the results of this present study seem not to correspond with others' (e.g., Libasin et al., 2021; Mu'awanah et al., 2021;

Yamsri, 2019). This suggests that further exploration of students' perspectives on online learning–synchronous and asynchronous–is warranted.

**RO2: To investigate the technostress experienced by science and non-science first-year university students**

**Table 2**

*Results of t-Test Technostress Experienced by First-year Science and Non-science Students*

| Technostress | Science students | | Non-science students | | | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *t* | *Sig* |
| Techno-Overload | 3.52 | 0.88 | 3.64 | 0.89 | -1.95 | .05 |
| Techno-Complexity | 2.83 | 0.95 | 2.88 | 0.99 | -0.80 | .42 |
| Techno-Uncertainty | 2.73 | 0.85 | 2.95 | 0.91 | -3.62 | .00 |
| Techno-Insecurity | 2.95 | 0.86 | 2.96 | 0.92 | -0.11 | .91 |

Table 2 indicates that first-year science students experienced varying levels of technostress when engaging with online learning, with techno-overload being the most pronounced ($M = 3.52$, $SD = 0.88$). On the other hand, techno-complexity ($M = 2.83$, $SD = 0.95$), techno-uncertainty ($M = 2.73$, $SD = 0.85$), and techno-insecurity ($M = 2.95$, $SD = 0.86$) were seen to be associated with technostress to a less pronounced degree.

In addition, Table 2 exhibits the technostress level of non-science students, showing that techno-overload was relatively high ($M = 3.64$, $SD = 0.89$) followed by techno-insecurity ($M = 2.96$, $SD = 0.92$), techno-uncertainty ($M = 2.95$, $SD = 0.91$), and techno-complexity ($M = 2.88$, $SD = 0.99$). The results indicate that when first-year non-science students participated in online learning, they encountered different degrees of technostress, with techno-overload being the most prominent aspect.

Both groups of students experienced high levels of techno-overload, as well as moderate levels of techno-insecurity. According to Fawaz and Samaha (2020) and Li and Wang (2021), the introduction of technology for the delivery of classes entails more demanding requirements in terms of stricter deadlines and a higher load of assignment completion, alongside the incorporation of different learning modes and various platforms used by different instructors during the semester such as synchronous via Zoom, asynchronous via myCourseville, Blackboard, or Google Classroom, or both synchronous and asynchronous.

With regard to techno-insecurity, the students reported being stressed by poor Internet connections and technical issues interrupting their classes, revision, or practice, or causing failed online submission of assignments. This result aligns with the studies of Hussein et al. (2020), Maqableh and Alia (2021), and Prasertsong et al. (2021), and it also lends support to the study of Alibak et al. (2019) concerning techno-insecurity. Additionally, the present study's results correspond with those of Anwar and Wahid (2021), whose students also expressed concerns about accessing the Internet during online lessons, especially synchronous lessons. Their students encountered stress due to disruptions in each session of online instruction caused by issues with internet connections and electronic equipment. This result is consistent with the research of Mu'awanah et al. (2021), which highlighted the impact of technological insecurities on students' learning experiences. Similarly, in Banack et al. (2021) and Iramaneerat's (n.d.) studies of synchronous online learning, students reported feelings of malaise resulting from techno-overload, techno-complexity, and techno-insecurity. It seems that a great deal of preparation is needed for online learning, particularly when different courses incorporate different platforms, such as Zoom, Microsoft Teams, and Google Meet (Fawaz & Samaha, 2020).

Moreover, the rankings of the third and fourth types of technostress experienced by science and non-science students were different. Techno-complexity was the third most prevalent form of technostress among the science

students, with techno-uncertainty coming fourth, while these rankings were reversed among their non-science counterparts. It is likely that individual students who came to class with different educational backgrounds and experience came across different types of technostress because of high technological demands, complex processes, and feelings of insecurity while engaging in both modes of online learning.

Regarding techno-complexity, the students had to adapt to the immediate introduction of online learning and learn to use such applications as Zoom, Microsoft Teams, and Google Meet, which is likely to have caused. This explanation aligns with the research of Byungura et al. (2018).

Furthermore, in terms of the asynchronous mode, the flexibility of this mode can allow instructors and students to complete their teaching and learning tasks at different timeslots (Banack et al., 2021; Iramaneerat, n.d.; Lytvyn et al., 2021). Thus, questions raised by students about instructional content cannot be resolved spontaneously. The students are likely to experience technostress as a result. Similar findings were reported by Libasin et al. (2021), but surprisingly, Raymond et al. (2016) found otherwise.

For each type of technostress, the only one that showed statistical significance in terms of mean difference was techno-uncertainty ($t(801) = -3.62$; $p = .00$). Non-science students experienced higher techno-uncertainty ($M = 2.95$, $SD = 0.91$) than science students ($M = 2.72$, $SD = 0.85$). The students in this study experienced tension perhaps because they were unfamiliar with various instructional and learning platforms utilized in online learning, used by different instructors, and thus apprehensive about using the features of these applications. Alternatively, they might have been stressed by unrealistic expectations about their ability to stay abreast of online learning technology (Li & Wang, 2021).

## 5. Conclusion and Implications of the Results

It can be concluded that the first-year university students held clear perspectives on online learning. The non-science students were more positive about asynchronous learning than their science counterparts.

Clearly, online learning is no longer a 'new normal' practice. The transition from pandemic to endemic COVID-19 may result in more positive perspectives on online learning as well as less technostress among students. As online learning tends to be a common practice, it is recommended that instructors assign a suitable workload that fulfills course requirements without overwhelming students. Minimizing stress from techno-overload can be achieved by incorporating a single instructional application. Moreover, instructors must take the lead in enhancing the quality of online learning by adopting appropriate methods – both synchronous and asynchronous modes. By effectively integrating face-to-face and online learning, universities can alleviate students' stress and meet their preference for in-person learning while harnessing the benefits of synchronous and asynchronous modes. Furthermore, due to variations in the learning preferences of science and non-science students, instructors may find it necessary to modify their online instructional approaches, both in synchronous and asynchronous modes, in order to effectively cater to the needs of these distinct student groups. As discussed earlier in the results and discussion section, the non-science students were more positive toward asynchronous mode than their science counterparts; therefore, asynchronous mode should be integrated more into online learning lessons for non-science students.

## 6. Recommendations for future research

Since universities not only comprise first-year students but also students at higher academic levels and years of study, one of several interesting avenues for exploration would be to examine how university students from more senior years, who are exposed to online learning, more complex subjects, advanced coursework, and possibly a heavier workload, experience technostress compared to first-year

university students. Understanding the unique challenges and stress triggers faced by senior students in managing online learning and advanced coursework could provide valuable insights for instructional design and learning support systems.

Furthermore, it would be valuable to investigate the perspectives of the instructors on online instruction management and their own experiences of technostress. Investigating how instructors navigate the demands of online teaching, the level of technostress and the strategies they employ to mitigate it could shed some light on effective pedagogical approaches and the role of instructor support in reducing student technostress.

## 7. Limitation of the study

The study focused specifically on the perspectives on online learning and technostress experienced by first-year students who underwent a sudden transition from secondary to higher education and from face-to-face to online learning. This study utilized a quantitative approach, which may limit the comprehensive understanding of the perspectives on online learning and technostress experienced by first-year university students. Consequently, the findings may not fully capture the nuances and complexities of the perspectives on online learning and technostress experienced by the students. It is recommended that further research be conducted by employing a qualitative approach, using in-depth interviews and observations, which can offer valuable insights into their perspectives on online learning and technostress.

## 8. About the Authors

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## 10. References

Agboola, A. A., & Olasanmi, O. O. (2016). Technological stressors in developing countries. *Open Journal of Applied Sciences*, *6*(4), 248–259. http://dx.doi.org/10.4236/ojapps.2016.64025

Alibak, M., Talebi, H. & Neshat-Doost H. T. (2019) Development and validation of a test anxiety inventory for online learning students. *Journal of Educators Online*, *16*(2), 1–16. https://www.thejeo.com/archive/archive/2019_162/alibak_talebi_neshat_doost

Anwar, I. W., & Wahid, J. H. (2021). Learners' perception on online learning implementation during COVID-19 pandemic. *Journal of Languages and Language Teaching*, *9*(2), 126–138. https://doi.org/10.33394/jollt.v9i2.3576

Banack, H. R., Lesko, C. R., Whitcomb, B. C., & Kobayashi, L. C. (2021). Teaching epidemiology online (pandemic edition). *American Journal of Epidemiology*, *190*(7), 1183–1189. https://doi.org/10.1093/aje/kwaa285

Bhalla, R., Tiwari, P., & Chowdhary, N. (2021). Digital natives leading the world: paragons and values of generation Z. In N. Stylos, R. Rahimi, O. Benkedul, &

S. Williams (Eds.), *Generation Z marketing and management in tourism and hospitality*. (pp. 3–23). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-70695-1_1

Brod, C. (1982). Managing technostress: Optimizing the use of computer technology. *Personnel Journal*, *61*(10), 753–757.

Byl, E., Struyven, K., Meurs, P., Bieke, A., Tom, V., Nadine, E., & Koen, L. (2016). The value of peer learning for first-year postgraduate university students' social and academic integration. *Procedia-Social and Behavioral Sciences, 228*, 299–304. https://doi.org/10.1016/j.sbspro.2016.07.044

Byungura, J. C., Hansson, H., Muparasi, M., & Ruhinda, B. (2018). Familiarity with technology among first-year students in Rwandan tertiary education. *The Electronic Journal of e-Learning, 16*(1), 30–45.

Chen, A., & Samsudin, M. (2022). Comparison of learning preference and learning challenges between science and non-science university students. *Social and Management Research Journal, 19*(1), 107–132. https://doi.org/10.24191/smrj.v19i1.17249

Christian, M., Purwanto, E. & Wibowo, S. (2020). Technostress creators on teaching performance of private universities in Jakarta during Covid-19 pandemic. *Technology Reports of Kansai University, 62*(6), 2799–2809.

Daniel, S. J. (2020). Education and the COVID-19 pandemic. *Prospects 49*, 91–96 https://doi.org/10.1007/s11125-020-09464-3

Davis, N. L., Gough, M., & Taylor, L. L. (2019). Online teaching: Advantages, obstacles and tools for getting it right. *Journal of Teaching in Travel & Tourism*, *19*(3), 256–263. https://doi.org/10.1080/15313220.2019.1612313

Estrada-Muñoz, C., Vega-Muñoz, A., Castillo, D., Müller-Pérez, S., & Boada-Grau, J. (2021). Technostress of Chilean teachers in the context of the COVID-19 pandemic and teleworking. *International Journal of Environmental Research and Public Health*, *18*(10), Article 5458. https://doi.org/10.3390/ijerph18105458

Fawaz, M., & Samaha, A. (2020). E-learning: Depression, anxiety, and stress symptomatology among Lebanese university students during COVID-19 quarantine. *Nursing Forum, 56*(1), 52–57. https://doi.org/10.1111/nuf.12521

Fruehwirth, J. C., Biswas, S., & Perreira, K. M. (2021). The COVID-19 pandemic and mental health of first-year college students: Examining the effect of COVID-19 stressors using longitudinal data. *PLOS ONE, 16*(3), Article e0247999. https://doi.org/10.1371/journal.pone.0247999

Gentina, E. (2020), Generation Z in Asia: A research agenda, In Gentina, E. and Parry, E. (Eds.), *The new generation Z in Asia: Dynamics, differences, digitalization (The changing context of managing people)*. (pp. 3–19). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80043-220-820201002

Hayat, M. S., Djuniadi, D., Prasetyo, A. P. B., Roshayanti, F., Wicaksono, A. G. C., Minarti, I. B., & Sumarno, S. (2019). Comparison of argumentation skill in science and non-science undergraduate students. *Journal of Physics: Conference Series, 1157*(2), Article 022023. https://doi.org/10.1088/1742-6596/1157/2/022023

Hussein, E., Daoud, S., Alrabaiah, H., & Badawi, R. (2020). Exploring undergraduate students' attitudes towards emergency online learning during COVID-19: A case from the UAE. *Children and Youth Services Review*, *119*, Article 105699. https://doi.org/10.1016/j.childyouth.2020.105699

Iramaneerat, C. (n.d.). ข้อแนะนำในการจัดการเรียนการสอน online [Suggestions for online teaching management]. from http://www.cotmes.net/wp-content/uploads/2020/10/682_Online-teaching-รศ.ดร.นพ.เชิดศักดิ์-ไอรมณีรัตน์.pdf

Kemp, N., & Grieve, R. (2014). Face-to-face or Face-to-screen? Undergraduates' opinions and test performance in classroom vs. online learning. *Frontiers in Psychology, 5*, Article 1278. https://doi.org/10.3389/fpsyg.2014.01278

Li, L. & Wang, X. (2021). Technostress inhibitors and creators and their impacts on university teachers' work performance in higher education. *Cognition, Technology & Work, 23*, 315–330. https://doi.org/10.1007/s10111-020-00625-0

Libasin, Z., Azudin, A. R., Idris, N. A., Rahman, M. S. A., & Umar, N. (2021). Comparison of students' academic performance in mathematics course with synchronous and asynchronous online learning environments during COVID-19 crisis. *International Journal of Academic Research in Progressive Education and Development*, *10*(2), 492–501. http://dx.doi.org/10.6007/IJARPED/v10-i2/10131

Liu, S. Y., & Tsai, C. C. (2008). Differences in the scientific epistemological views of undergraduate students. *International Journal of Science Education*, *30*(8), 1055–1073. https://doi.org/10.1080/09500690701338901

Lytvyn, V., Akimova, O., Kuznetsova, H., Zenchenko, T., Stepanenko, O., & Koreneva, I. (2021). The use of synchronous and asynchronous teaching methods in pedagogical education in COVID-19 terms. *International Journal of Health Sciences*, *5*(3), 617–629. https://doi.org/10.53730/ijhs.v5n3.2681

Mällinen, S. (2001). Teacher effectiveness and online learning. In J. Stephenson (Ed.), *Teaching & Learning Online: New pedagogies for new technologies*. (pp. 139–149). Routledge.

Marchiori, D. M., Mainardes, E. W., & Rodrigues, R. G. (2019). Do individual characteristics influence the types of technostress reported by workers?. *International Journal of Human–Computer Interaction*, *35*(3), 218–230. https://doi.org/10.1080/10447318.2018.1449713

Maqableh, M., & Alia, M. (2021). Evaluation online learning of undergraduate students under lockdown amidst COVID-19 Pandemic: The online learning experience and students' satisfaction. *Children and Youth Services Review*, *128*, Article 106160. https://doi.org/10.1016/j.childyouth.2021.106160

Moawad, R. A. (2020). Online learning during the COVID-19 pandemic and academic stress in university students. *Revista Romaneasca pentru Educatie Multidimensionala [Journal for Multidimensional Education], 12*(1), 100–107. https://doi.org/10.18662/rrem/12.1sup2/252

Mohr, K. A., & Mohr, E. S. (2017). Understanding generation Z students to promote a contemporary learning environment. *Journal on Empowering Teaching Excellence*, *1*(1), Article 9. https://doi.org/10.15142/T3M05T

Mu'awanah, N., Sumardi, S., & Suparno, S. (2021). Using Zoom to support English learning during COVID-19 pandemic: Strengths and challenges. *Jurnal Ilmiah Sekolah Dasar*, *5*(2), 222–230. https://doi.org/10.23887/jisd.v5i2.35006

Müller, A. M., Goh, C., Lim, L. Z., & Gao, X. (2021). Covid-19 emergency eLearning and beyond: Experiences and perspectives of university educators. *Education Sciences*, *11*(1). Article 19. https://doi.org/10.3390/educsci11010019

Ngampornchai, A., & Adams, J. (2016). Students' acceptance and readiness for E-learning in northeastern Thailand. *International Journal of Educational Technology in Higher Education, 13,* Article 34. https://doi.org/10.1186/s41239-016-0034-x

Od, O., & Ei, A. (2014). Relevance of educational media and multimedia technology for effective service delivery in teaching and learning processes. *IOSR Journal of Research & Method in Education, 4*(2), 48–51. https://doi.org/10.9790/7388-04214851

Office of the Registrar. (2021, September 20). *Number of students (Semester system).* Chulalongkorn University. Retrieved September 20, 2021, from https://www.reg.chula.ac.th/statistics/statistics-three.html

Pei, L. & Wu, H. (2019) Does online learning work better than offline learning in undergraduate medical education? A systematic review and meta-analysis. *Medical Education Online*, *24*(1), Article 1666538. https://doi.org/10.1080/10872981.2019.1666538

Petchprayoon, C., Lertratdechakul, C., & Pattanapakdee, N. (2011) Self-adjustment ability of first year students in public university [ความสามารถในการปรับตัวของนักศึกษาชั้นปีที่ ๑ ในมหาวิทยาลัยของรัฐ]. *The Journal of KMUTNB. 21*(1). 157–166. https://www.thaiscience.info/journals/Article/TJKM/10767076.pdf

Prasertsong, C., Sanghirunruttana, J. & Kladkaew, P. (2021). The factors related to stress of online learning to the COVID-19 situation among nursing

students [ปัจจัยที่มีความสัมพันธ์กับความเครียดในการเรียนออนไลน์จากสถานการณ์โควิด-19 ของนักศึกษาพยาบาล]. *Journal of Somdet Chaopraya Institute of Psychiatry. 15*(1). 14–28. https://he01.tci-thaijo.org/index.php/journalsomdetchaopraya/article/view/246152/168263

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. *Information systems research*, *19*(4), 417–433. https://doi.org/10.1287/isre.1070.0165

Raymond, E., Atsumbe, B. N., Okwori, R. O. & Jebba, M. A. (2016). Comparative effects of the synchronous and the asynchronous instructional approaches concerning the students' achievements and interests in electrical engineering at the Niger State College of Education. *International Journal of Engineering Pedagogy, 6*(3), 4–9. http://repository.futminna.edu.ng:8080/jspui/handle/123456789/3334

Satyawan, I. M., Wahjoedi, W., & Swadesi, I. K. I. (2021). The effectiveness of online learning through Undiksha e-learning during the covid-19 pandemic. *Journal of Education Technology*, *5*(2), 191–199. https://doi.org/10.23887/jet.v5i2.32364

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions of online learning (1988-2018). *American Journal of Distance Education*, *33*(4), 289–306. https://doi.org/10.1080/08923647.2019.1663082

Somasri, P. (2013). *A study of undergraduate students' lifestyle at Srinakharinwirot University [การศึกษาการใช้ชีวิตของนิสิตระดับปริญญาตรี มหาวิทยาลัยศรีนครินทรวิโรฒ]*. [Master's thesis, Srinakarinwirot University]. Srinakharinwirot University. https://ir.swu.ac.th/jspui/handle/123456789/4297

Sulha, A. H., Famela, A. K., & Harahap, A. T. A. (2021). The implementation of synchronous and asynchronous learning in English as foreign language setting. *ETDC: Indonesian Journal of Research and Educational Review*, *1*(1), 17–27. https://doi.org/10.51574/ijrer.v1i1.50

Teo, T., Khlaisang, J., Thammetar, T., Ruangrit, N., Satiman, A., & Sunphakitjumnong, K. (2014). A survey of pre-service teachers' acceptance of technology in Thailand. *Asia Pacific Education Review*, *15*, 609–616. https://doi.org/10.1007/s12564-014-9348-3

Tsai, C. (1996). The "Qualitative" differences in problem-solving procedures and thinking structures between science and nonscience majors. *School Science and Mathematics*, *96*(6), 283–289. https://doi.org/10.1111/j.1949-8594.1996.tb15837.x

Upadhyaya, P. & Vrinda. (2021). Impact of technostress on academic productivity of university students. *Education & Information Technologies*, *26,* 1647–1664. https://doi.org/10.1007/s10639-020-10319-9

Vergara-Rodríguez, D., Antón-Sancho, Á., & Fernández-Arias, P. (2022). Variables influencing professors' adaptation to digital learning environments during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *19*(6), Article 3732. https://doi.org/10.3390/ijerph19063732

Volery, T. & Lord, D. (2000), Critical success factors in online education. *International Journal of Educational Management*, *14*(5), 216–223. https://doi.org/10.1108/09513540010344731

Yamane. (1973). *Statistics: An introductory analysis* (3rd ed.). Harper & Row.

Yamsri, K. (2019). Effectiveness of using the Zoom cloud meeting application tutorial in midwifery practicum [ประสิทธิผลของการใช้แอปพลิเคชั่น Zoom cloud meeting ช่วยสอนในรายวิชาปฏิบัติการผดุงครรภ์]. *Mahasarakham Hospital Journal. 16(*2). 36–42. https://he02.tci-thaijo.org/index.php/MKHJ/article/view/219148/151738

Yang, C., Chen, A., & Chen, Y. (2021). College students' stress and health in the COVID-19 pandemic: The role of academic workload, separation from school, and fears of contagion. *PLOS ONE. 16*(2), Article e0246676. https://doi.org/10.1371/journal.pone.0246676

## 11. Appendix

### Questionnaire

### "Perspectives on Online Learning and Technostress Experienced by First-Year Students during COVID-19 Pandemic"

**Instructions**: Please answer the questionnaire. Your answers will be kept confidential, and responding to the questionnaire does not impact your grades.

**Part 1 Personal Information**

**1. Gender**

- □ Male
- □ Female

**2. Age**

- □ 17 Years Old
- □ 18 Years Old
- □ 19 Years Old
- □ Over 19 Years Old

**3. Faculty**

- □ Faculty of Commerce and Accountancy
- □ Faculty of Medicine
- □ Faculty of Economics
- □ Faculty of Dentistry
- □ Faculty of Education
- □ Faculty of Veterinary Science
- □ Faculty of Communication Arts
- □ Faculty of Pharmaceutical Science
- □ Faculty of Law
- □ Faculty of Engineering
- □ Faculty of Fine and Applied Arts
- □ Faculty of Architecture
- □ Faculty of Psychology
- □ Faculty of Science
- □ Faculty of Arts
- □ Faculty of Allied Health Sciences
- □ Faculty of Political Science
- □ Faculty of Sport Science
- □ School of Agricultural Resources

**4. Online Learning Platforms**

- □ Zoom
- □ myCourseville
- □ Google Classroom
- □ Blackboard
- □ Others

**5. No of subjects/courses enrolled in the current semester: _____**

**Part 2 Perspectives on online leaching**

**Instructions**: Please tick the box that matches your opinion.

(5= Strongly Agree/4= Agree/3= Neutral /2= Disagree/1= Strongly Disagree)

**2.1 Perspectives on synchronous learning platforms, e.g., Zoom, Microsoft Team, Line Call**

| Opinion | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) |
|---|---|---|---|---|---|
| 1. **Synchronous learning** enables you to achieve the lesson's objectives and complete the lessons. | | | | | |
| 2. **Synchronous learning** helps enhancing communication among you, your teachers, and classmates. | | | | | |
| 3. **Synchronous learning** facilitates in-class activities. | | | | | |
| 4. **Synchronous learning** enables you and classmates to exchange and share what you have learned in class. | | | | | |
| 5. **Synchronous learning** is convenient for you to review and revisit the lessons, as well as participating in class discussions. | | | | | |
| 6. In **synchronous learning,** teachers can provide a complete explanation to you | | | | | |

| Opinion | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) |
|---|---|---|---|---|---|
| and other students when you/they ask questions. | | | | | |
| 7. **Synchronous learning** provides you with the opportunity to showcase your full learning potential through completing assignments and exams. | | | | | |
| 8. In **synchronous learning,** you can receive feedback every time after submitting assignments. | | | | | |
| 9. In **synchronous learning,** you have a regular learning schedule that can reduce problems and difficulties in time management for studying. | | | | | |
| 10. In **synchronous learning,** you feel a sense of closeness, and it is easy to access your teachers. | | | | | |

## 2.2 Perspectives asynchronous learning platforms, e.g., Blackboard, myCourseville, Google Classroom

| Opinion | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) |
|---|---|---|---|---|---|
| 11. **Asynchronous learning** enables you to achieve lesson's objectives and complete the lessons. | | | | | |
| 12. **Asynchronous learning** helps enhancing communication among the you, your teachers, and classmates. | | | | | |
| 13. **Asynchronous learning** facilitates in-class activities. | | | | | |
| 14. **Asynchronous learning** enables you and your | | | | | |

| Opinion | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) |
|---|---|---|---|---|---|
| classmates to exchange and share what you have learned in class. | | | | | |
| 15. **Asynchronous learning** is convenient for you to review and revisit the lesson as well as participate in class discussions. | | | | | |
| 16. In **asynchronous learning,** your teachers can provide a complete explanation to students when they ask questions. | | | | | |
| 17. **Asynchronous learning** provides you with opportunities to showcase your full learning potential through completing assignments and exams. | | | | | |
| 18. In **asynchronous learning,** you can receive feedback every time after submitting assignments. | | | | | |
| 19. In **asynchronous learning,** you are not obliged to learning schedule that can reduce problems and difficulties in time management for studying. | | | | | |
| 20. In **asynchronous learning,** you feel a sense of closeness and it is easy to access your teachers. | | | | | |

## Part 3 Technostress

(5= Strongly Agree/4= Agree/3= Neutral /2= Disagree/1= Strongly Disagree)

| Technostress | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) |
|---|---|---|---|---|---|
| **3.1 Techno-Overload** | | | | | |
| 1. You have been forced by the online learning technology to work more and faster. | | | | | |
| 2. Online teaching-learning technology makes it harder for you to manage your workload. | | | | | |
| 3. You feel that the online teaching-learning technology makes your learning schedules tighter. | | | | | |
| 4. You need to adapt your learning behavior to align with the online learning technology. | | | | | |
| 5. You have more burden in studying due to the complexity of the online learning technology. | | | | | |
| **3.2 Techno-Complexity** | | | | | |
| 6. It takes a long time for you to completely understand the online learning technology. | | | | | |
| 7. You are unable to handle the online teaching-learning technology to complete the assignments. | | | | | |
| 8. You don't have enough time to learn how to use the online teaching-learning technology. | | | | | |
| 9. Your classmates have a better understanding of the online teaching-learning technology than you do. | | | | | |
| 10. The online teaching-learning technology is too complicated to understand. | | | | | |

| Technostress | Strongly Agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly Disagree (1) |
|---|---|---|---|---|---|
| **3.3 Techno-Uncertainty** | | | | | |
| 11. The new online teaching technologies are decreasing your learning efficiency. | | | | | |
| 12. You need to consistently enhance your skills in online teaching technology to improve your learning efficiency. | | | | | |
| 13. You have been threatened by classmates who have more advanced knowledge about online learning technology. | | | | | |
| 14. You refrain from sharing knowledge with classmates due to the fear of your inadequate performance. | | | | | |
| 15. You engage in less knowledge-sharing with classmates due to the fear of your inadequate performance. | | | | | |
| **3.4 Techno-Insecurity** | | | | | |
| 16. You feel that the university is continually advancing online learning technology. | | | | | |
| 17. You feel that the university's online learning technology is continually evolving. | | | | | |
| 18. You feel that the university's online learning technology are compatible with your learning devices. | | | | | |
| 19. You feel that the university' s internet network undergoes constant changes. | | | | | |
| 20. You feel that the university' s online teaching platforms and features always change. | | | | | |